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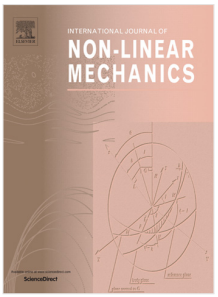

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ANALYTICAL AND NUMERICAL BIFURCATION ANALYSIS OF DISLOCATION PATTERN FORMATION OF THE WALGRAEF-AIFANTIS MODEL

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Abstract. We analyse the pattern formation due to dislocations under cyclic loading resulting from the Walgraef-Aifantis model. The model consists of a set of partial differential equations of the reaction-diffusion type in the one dimensional finite space with two different diffusion-like coefficients, for the mobile (free to move when the applied resolved shear stress in the slip plane exceeds a certain threshold) and for the immobile (of slow movement or trapped) dislocations. We derive analytically the Turing spatial and Andronov-Hopf temporal instabilities emanating from the homogenous solutions and construct the complete bifurcation diagram of the far-from-equilibirum spatio-temporal patterns, with respect to the applied stress and the size of the domain. Finally, we analyse the symmetric properties of all branches of both steady and oscillating far-from-equilibirum regimes.

Keywords: Dislocations; Pattern Formation; Turing Instabilities; Numerical Analysis